

Claims

- [c1] 1. An apparatus for fixing latency of an operation within a deterministic region on a network, the apparatus comprising:
- a network interface modem in communication with the network;
 - a high priority module in communication with the network interface modem;
 - the high priority module comprising a packet assembler/disassembler, and hardware for performing at least one operation; and
 - at least one deterministic peripheral device connected to the high priority module;
- wherein the fixed latency hardware performs operations on the deterministic peripheral device according to instructions received and interpreted by the packet assembler/disassembler.
- [c2] 2. The apparatus of claim 1, wherein the network is integrated into a downhole network.
- [c3] 3. The apparatus of claim 1, wherein the hardware of the high priority module is selected from the group consisting of at least one hardwired circuit, at least one inte-

grated circuit, and at least one FPGA.

- [c4] 4.The apparatus of claim 1, wherein the packet assembler/disassembler comprises a packet assembler and a packet disassembler wherein the packet assembler and the packet disassembler are two separate circuits.
- [c5] 5.The apparatus of claim 1, wherein the at least one deterministic peripheral device is selected from the group consisting of a clock, a local clock source, at least one timer, at least one analog circuit, at least one digital circuit and at least one actuator.
- [c6] 6.The apparatus of claim 5, wherein the clock is a hardware integrated circuit.
- [c7] 7.The apparatus of claim 5, wherein the local clock source is selected from the group consisting of at least one crystal, at least one transistor, at least one oscillator, at least one RC circuit, at least one LC circuit, and at least one RLC circuit.
- [c8] 8.The apparatus of claim 5, wherein the clock is synchronized to a GPS clock or a clock source over a LAN.
- [c9] 9.The apparatus of claim 1, wherein the high priority module is in communication with devices selected from the group consisting of a data buffer, at least one router,

at least one node, at least one tool port, at least one data acquisition device.

[c10] 10.The apparatus of claim 1, wherein the high priority module is part of the network interface modem.

[c11] 11.The apparatus of claim 1, wherein the deterministic region encompasses devices selected from the group consisting of the high priority module, the network interface modem, and the at least one deterministic peripheral device.

[c12] 12.A method for performing an operation within a deterministic region comprising:
providing a high priority module connected to a network interface modem in communication with a network;
recognizing by the high priority module a packet as the operation; and
performing the operation within the deterministic region and on a peripheral device.

[c13] 13.The method of claim 12, wherein the network is integrated into a downhole tool string.

[c14] 14.The method of claim 12, wherein the high priority module fills a field in the packet with data from the peripheral device.

- [c15] 15.The method of claim 12, wherein the high priority module connected to a buffer.
- [c16] 16.The method of claim 15, wherein the packet is received from a device selected from the group consisting of a network interface modem, a buffer, a router, a local node, a tool port, and a data acquisition device.
- [c17] 17.The method of claim 15, wherein the method further comprises the step of forwarding a packet by the high priority module.
- [c18] 18.The method of claim 17, wherein the packet is forwarded to a device selected from the group consisting of a network interface modem, a buffer, a router, a local node, a tool port, and a data acquisition device.
- [c19] 19.The method of claim 17, wherein the packet forwarded is selected from the group consisting of the packet and a packet modified by the operation.
- [c20] 20.The method of claim 12, wherein the operation is a high priority operation which is performed immediately upon recognition.
- [c21] 21.An apparatus for fixing latency of an operation within a deterministic region on a downhole network integrated into a tool string; the apparatus comprising:

a control device near the surface of the downhole tool string, the control device comprises a network interface modem in communication with the downhole network, a high priority module in communication with the network interface modem, and at least one deterministic peripheral device connected to the high priority module;

a downhole device comprising a network interface modem in communication with the downhole network, a high priority module in communication with the network interface modem, and at least one deterministic peripheral device connected to the high priority module.

[c22] 22.The apparatus of claim 21, wherein the control device is a computer.

[c23] 23.The apparatus of claim 22, wherein the network interface modem and the high priority module are on an insertable computer card.

[c24] 24.The apparatus of claim 21, wherein the control device further comprises a connection to a local area network.

[c25] 25.The apparatus of claim 21, wherein the at least one deterministic peripheral device is selected from the group consisting of a local clock source, at least one analog circuit, at least one actuator, a clock, and a hardware clock integrated circuit.

- [c26] 26.The apparatus of claim 25, wherein the local clock source is selected from the group consisting of at least one crystal, at least one transistor, at least one oscillator, at least one RC circuit, at least one LC circuit, and at least one RLC circuit.
- [c27] 27.The apparatus of claim 25, wherein the clock is synchronized to a GPS clock.
- [c28] 28.The apparatus of claim 21, wherein the high priority module is part of the network interface modem.
- [c29] 29.The apparatus of claim 21, wherein the deterministic region encompasses devices on the network selected from the group consisting of transmission media, the high priority module, the network interface modem, and the at least one deterministic peripheral device.
- [c30] 30.The apparatus of claim 21, wherein the downhole device comprises non-deterministic devices selected from the group consisting of a data buffer, at least one router, at least one node, local node circuitry, at least one tool port, and at least one data acquisition device.